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ABSTRACT

The evolution of PRIME networking at the University of Arizona is described. A network of super minicomputers dedicated to administrative computing was established that accommodated online, interactive applications and that supported a variety of software packages to aid in the rapid development of systems. The first microcomputer, a PRIME 550, was obtained to support the undergraduate admissions system. Initially, the approach was to decentralize hardware systems by locating the computers in user areas or in close proximity. A purchasing vendor system was developed, followed by a personnel/payroll/budgeting system. A PRIME 750 was purchased by the student services department to support systems for student health, student housing, and financial aid development. Another PRIME 550 was purchased for alumni development and athletics. System overloading problems fell into three general categories: technical support, operations support, and proprietary rights. In lieu of having a large mainframe, minicomputer "building blocks" have been used to effect an affordable and sophisticated network that can handle numerous large online systems, while retaining the flexibility of adding additional systems and of sharing data in a planned manner. (SW)

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# PRIME NETWORKING AT THE UNIVERSITY OF ARIZONA

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Networking at the University of Arizona has progressed through many stages beginning with one PRIME 550 and growing into the current configuration of two PRIME 550's, a 750, an 850, and two 9950's on order.

This paper will cover the evolution of the network, some of the problems encountered and the solutions utilized to solve these problems.

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# PRIME NETWORKING AT THE UNIVERSITY OF ARIZONA

Working on the premise that the University's administration could better survive with up-to-the-minute information, the Administrative Data Processing Department (ADP), of the University of Arizona undertook a review in 1980 of the alternatives available in computer hardware systems. This review included systems currently installed at the University as well as outside vendor hardware. The systems in use at that time included a Control Data Corporation (CDC) CYBER, and several Digital Equipment Corporation (DEC) systems. These systems were shared for administrative and academic purposes and while the DEC Systems offered some interactive processing, the resources were already saturated and did not provide for sufficient interactive computer support to meet the anticipated administrative demands. While the total administrative computing requirement was still undefined, it was recognized that a solution was necessary which would take advantage of the latest technology, allow the greatest amount of flexibility to accommodate newly defined users and applications, and permit redesign/programming of "old" systems in order to utilize the advanced techniques available. Several sessions were held with computer vendors to learn what kinds of systems were available to satisfy the University's projected needs.

The resulting proposal was to install a network of systems commonly referred to as "super" minicomputers, to be dedicated solely to administrative computing. Superminis are extremely powerful computers and rival the capabilities of the mainframe systems of only a few years ago. With the supermini, The University of Arizona obtained a system that was relatively

low in initial cost, required a minimum of personnel support, allowed for modular growth and provided high speed communication between processors. The superminis are designed to accommodate on-line, interactive applications and support a variety of software packages to aid in the rapid development of systems.

The networking capabilities of the superminis allow them to be defined as "nodes" and linked in a distributed processing fashion. Distributed processing allows direct control of user hardware. A network allows the systems to be linked through telecommunications and thus access data from one node to another as may be desired. The creation of a unified shared administrative data bank is possible while maintaining the advantages of distributing the workload over multiple systems. One of the big advantages of the supermini network concept is the ability to retain large data files for instantaneous retrieval.

After an extensive evaluation of minicomputer systems, PRIME Computer Corporation was chosen as the University of Arizona's hardware vendor.

A similar evaluation to identify software development tools resulted in the purchase of TRANSACT, a full screen block mode system generator to interface to the COBOL applications to be designed.

The first of the minicomputers, a PRIME 550, was obtained to support the Undergraduate Admissions system. The development of a system for Police Citations was initiated prior to its delivery by timesharing at a local

engineering firm. This allowed some initial training and familiarization on a small system for the development staff.

At the time of the first installation the University of Arizona's approach was to decentralize hardware systems by locating the computers in user areas or in close proximity. In this way user departments would budget for their own hardware and fund the construction of a room in which to house the hardware. Using this concept, the first computer was installed in the Administration Building, two blocks from ADP.

Administrative Data Processing, prior to this time, was primarily a software development group. The network concept presented some unique challenges for ADP as a service organization in the areas of site planning and preparation, security, data base administration, facilities management consulting services, training, documentation and resource planning. User groups were established as a forum for communication between ADP and the user community.

Installation of the first PRIME Computer, the formation of user groups and the anticipation of additional machines sparked a dramatic interest in bringing the University into the state-of-the-art/interactive/real-time world. Soon, a Purchasing vendor system was developed and installed, followed shortly thereafter by a personnel/payroll/ budgeting system.

Development of new systems however, was complicated by the interfaces required to other production systems that were running on the DEC and CYBER computers. The only interface was magnetic tape, but with the decentralization of the PRIME computer, this interface became cumbersome due to the

physical distance between computers and the differences in the DEC, CYBER and PRIME system protocols.

By this time there were four production systems on the first PRIME 550. These were 1) Police Citations 2)Undergraduate Admissions 3)Purchasing Vendor system and 4) Payroll/Personnel/Budgeting system. All new development was also located on the 550. The 550 served approximately 40 terminals with 2 MB of memory, and user response time was suffering. This was due, in part, to the mix of production and development activities. Because of increasing user needs for processing capability, two additional systems were purchased. As with the first system, the additional computers were installed in decentralized user areas physically remote from ADP.

A PRIME 750 was purchased by the Student Services department to support systems for Student Health, Student Housing, and Financial Aids development. Another PRIME 550 was purchased by the Alumni Development Office and Athletic Department. Soon after arriving, the Student Services PRIME 750 was running a Student Health system with over 30 terminals on-line. The Student Housing system was under development with 8 terminals for programming and testing by the development group. The Alumni system 550 was running with over 20 terminals in operation.

Various problems with system overloading soon began to develop. These fell into three general categories:

1) Technical Support
2) Operations Support
3) Proprietary Rights

During the first 6-12 months of operation it became apparent that a technical support group was needed to address several issues with which ADP had no previous experience. These included systems software support, third party software support, systems administration, telecommunications and facilities planning. This group was created through reallocation of personnel within the department.

It also became apparent within a short period of time that at least limited operator support was required for the mini-computer. Two major problems were occurring. First, all major files on the PRIMES needed to be backed up at least once a day and, second, when large reports were printed, it was necessary for someone to monitor printer operations.

Since it was not possible to fund new operator positions, it again became necessary to absorb these functions within the department as had been done in providing technical support. Moreover, as systems became more sophisticated and the PRIME computers more saturated, operator support was necessary to respond when various systems were in contention for available resources.

Finally, because the initial PRIME hardware and systems development had been funded by the user departments, users felt they had proprietary rights to dictate use of their hardware. Sometimes to the chagrin of the primary users, it was necessary to allocate resources (based on University wide needs) which resulted in transfer of applications between computers. Throughout this, primary users were considered and resources maintained to process immediate and projected user needs. With the acquisition of more hardware and communication with users, these situations have been resolved

satisfactorily. All future hardware purchases are planned for the ADP installation to avoid these problems.

The current configuration at the University of Arizona includes four PRIME super minicomputers and two 2250 "Rabbit" systems. Due to the location of the computers, it is necessary to handle both local and remote system linkages. Since two of the machines are now located in the same room in ADP, they utilize PRIME's local area RINGNET via the PRIMENET Node Controllers (PNC). One of the remote site machines is connected via the Multiple Data Link Controller (MDLC). The University is planning for the acquisition of two PRIME 9950 computers. These will also be located in ADP and be linked to the network via PRIMENET Node Controllers. Future plans include the creation of a data base to encompass all data on PRIME systems. A data base administrator has been appointed to begin the planning, implementation and control of all data. The PRIME INFORMATION data base system has been purchased for use within the organization. Because of the current interface problems between INFORMATION and the current data structure, it is possible that all current production systems will need to be converted in the future. At the present time development is underway to create a complete comprehensive student data base under INFORMATION. The data base will be comprised of data from numerous files and give the University Administration ad-hoc reporting and query capabilities thus far not possible.

Progress to date at the University of Arizona Administrative Data Processing department has been significant. In lieu of having a large mainframe, ADP has used minicomputer "building blocks" to arrive at an affordable highly

sophisticated network. This network can handle numerous large on-line systems while retaining the flexibility of adding additional systems to the network and of sharing data in a controlled, planned manner. The minicomputer network will continue to expand as application development and implementation proceeds. Micro-computers and smart terminals will be installed in local and centralized areas of departments. Large minicomputers located in ADP will house databases that will be created from the database subsets currently on the PRIME machines. Database software, query languages, and a variety of easy to use powerful and flexible tools for information access, processing, retrieval, and display will be made available to the University. ADP, through its network approach, will be well on the way to meeting its goals of providing the administrative activities of the University with cost effective and efficient administrative operations, timely and useful data, and appropriate information for planning and management.